

REMARKS

The following is intended as a full and complete response to the Office Action dated January 4, 2008. Claims 1-25 were examined. Claims 1 and 3-5 are rejected under 35 U.S.C. § 102(e) as being unpatentable over Diard (US 7,075,541). Claims 6-7 and 22 are rejected under 35 U.S.C. § 102(e) as being unpatentable over Smith, et al. (US 2003/0179205). Claims 2, 8-21, and 23-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith in view of Diard. Claim 25 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith, in view of Diard, in further view of Yen (US 2004/0062443). By way of this reply, Applicants are cancelling claims 21-25, amending claims 1, 4-6, 8, 11-12, 13, and 17, and adding new claims 26-30.

Rejections Under 35 U.S.C. § 102(e)

Claim 1 is amended to recite the limitations of (i) the island data set including a collection of data matrices (ii) the IPE distributing data portions representing first constraint rows of the data matrices between the execution units and (iii) resolving the data portions of the first constraint rows in parallel and resolving data portions of the second constraint rows serially. The first constraint rows are associated with either the first common object or the second common object and the second constraint rows are associated with both the first common object and the second common object. A constraint row is shown in Figure 7 and described on page 36, lines 8-11 of the present application. The distribution of constraint rows to the execution units is described on page 29, line 18 – page 30, line 11. The resolving of a data portion of the second constraint rows serially is described by the skipping of constraint row 5 on page 32, lines 1-10. A “competing object pair” exists between the first common object and the second common object that are both associated with constraint row 5 and cause constraint row 5 to be resolved serially. Thus, none of the amendments introduces any new matter.

Claims 6 and 12 are each amended to recite the limitations of (i) the island data set including a collection of data matrices (ii) distributing constraint rows of the data matrices that do not include a competing object pair to the plurality of execution units for processing in parallel and (iii) distributing constraint rows of the data matrices that do include a competing object pair to the plurality of execution units for serial processing. Again, no new matter is introduced by these amendments.

Diard fails to teach or suggest the limitations of distributing constraint rows of matrices to a plurality of execution units. Diard teaches distributing processing of geometry data describing a scene between GPUs, where each GPU renders different portions of a display area in parallel, as described in column 7, lines 47-52. The different portions of the display area may be modified as needed to balance the processing load between the GPUs to maximize parallelism, as described in column 8, lines 20-25. The geometry data processed in parallel by the GPUs are not constraint rows of matrices. Additionally, Diard fails to teach that a first portion of the geometry data is resolved in parallel and a second portion of the geometry data is resolved serially, as recited in amended claims 1, 6, and 12.

Furthermore, Diard describes distributing the geometry data based on a destination position in the display area to improve rendering performance, as shown in Figure 8. The destination positions of the pixel data produced when the geometry data is processed (rendered) are known before the geometry data is processed. In contrast, the LCP solver of the present application distributes constraint rows of data matrices based on common object associations, not destination positions. The collection of data matrices define forces that are applied to objects, possibly effecting the positions of the objects in a display area. The destination positions of the objects are not known until after the constraint rows are resolved. Therefore, it is not possible to use the method taught by Diard to distribute constraint rows to execution units for the parallel processing of the first constraint rows. As previously described, Diard fails to teach or suggest serial processing of the second constraint rows.

Smith also fails to teach or suggest the limitations recited in amended claims 1, 6, and 12. Smith teaches using a single processor to compute position and velocity parameters of a rigid body system while ensuring that a first derivative of a constraint function is zero. Smith does not teach or suggest using a plurality of execution units or distributing constraint rows to execution units for resolution. Further, nowhere does Smith teach or suggest resolving first constraint rows in parallel and second constraint rows serially based on common object association. In particular, Smith does not teach or suggest distributing constraint rows based on whether or not competing object pairs exist in the constraint rows, as recited in amended claims 6 and 12.

The other references cited by the Examiner also fail to teach or suggest the limitations recited in amended claims 1, 6, and 12. Therefore, amended claims 1, 6, and 12 are patentable over the combination of the references cited by the Examiner. Further, claims 2-5,

7-11, and 13-15 depend from allowable claims 1, 6, and 12, respectively, and are therefore also patentable over any combination of the references cited by the Examiner.

In addition, claim 4 is amended to clarify the limitation that first data portion of the first constraint rows is transferred from a first execution unit to the second execution unit through the IPE memory, as described on page 33, lines 1-3 of the present application. Claim 5 is amended to clarify the limitation that the CAM is configured to store an entry for the first common object and the second common object as shown on page 28, lines 5-13 of the present application. Claims 8 and 11 are amended to conform with amended claim 6. Claims 13 and 17 are amended to conform with amended claim 12.

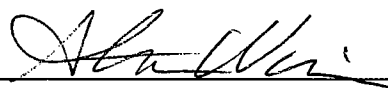
New Claims 26- 30

New claim 26 recites the limitation of distributing the second constraint rows to the plurality of execution units after the processing of the first constraint rows is complete, as described on page 32, lines 1-10 of the present application. New claim 27 recites the limitation of using an object identifier to address the CAM, as described on page 27, line 5 – page 28, line 6 of the present application. New claim 28 recites the limitation of storing an execution unit identifier and a count of reference to an object in a CAM entry, as described on page 28, lines 7-15 of the present application. New claim 29 recites the limitation of the collection of data matrices representing changes to velocities and forces influencing movement of the first common object and the second common object, as described on page 33, line 21 – page 34, line 1 of the present application. New claim 30 recites the limitation of configuring the plurality of execution units to perform an integration process to update positions of the first common object and the second common object, as described on page 34, lines 6-9 of the present application. Again, none of the cited references teach or suggest the limitations recited in new claims 26-30. Therefore, claims 26-30 are patentable over those references. Further more, claims 26-30 each depend from allowable claim 1.

CONCLUSION

Based on the above remarks, Applicants believe that they have overcome all of the rejections set forth in the Office Action mailed on January 4, 2008 and that the pending claims are in condition for allowance. If the Examiner has any questions, please contact the Applicant's undersigned representative at the number provided below.

Respectfully submitted,



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